

IN THE CLAIMS:

Please cancel Claim 3 without prejudice to or waiver of the subject matter contained therein.

Please amend Claim 1, as follows. All claims in the original application are being reproduced below in accordance with current U.S. Patent and Trademark Office requirements.

1. (Currently Amended) An electromagnetic actuator comprising:  
a core with a coil wound around said core;  
two stators magnetically coupled to each end of said core;  
a movable element which is displaceable relative to said stators; and  
supporting means for supporting said movable element,  
wherein said supporting means, said stators and said movable element are made of the same material, and  
wherein said stators and said movable element each have a projection and a depression in such a way that the projection and depression of said stators engage with the projection and depression of said movable element, side surfaces of the projection and depression being parallel to the displacement direction of the movable element and partially overlapping even if there is no electromagnetic force.
2. (Previously Presented) The electromagnetic actuator according to claim 1, wherein said supporting means said stators are fixed onto a substrate.

Claim 3 (Cancelled).

4. (Previously Presented) The electromagnetic actuator according to claim 1, wherein said supporting means is a parallel hinge spring made up of a plurality of flat springs combined in parallel, and the projections and depressions of said stators and the projections and depressions of said movable element are formed like comb-teeth parallel to the direction of movement of said parallel hinge spring.

5. (Previously Presented) The electromagnetic actuator according to claim 1, wherein said supporting means is a concentric hinge spring combining a plurality of flat springs in a concentric radial form, and the projections and depressions of said stators and the projections and depressions of said movable element are formed in a concentric form around the center of rotation of said concentric hinge spring.

6. (Original) An optical scanner, comprising:  
a movable mirror; and  
the electromagnetic actuator according to claim 1 mechanically connected with said movable mirror.

7. (Withdrawn) A method of manufacturing the electromagnetic actuator according to claim 1, wherein a process of manufacturing said stators, said movable element and said supporting means comprises:

a step of forming a sacrificial layer on a substrate;  
a step of forming an electrode layer on said substrate and said sacrificial layer;  
a step of forming an insulated female mold layer on said electrode layer;  
a step of electroplating a magnetic layer in an opening of said insulated female mold layer on said electrode layer; and  
a step of removing said insulated female mold layer and said sacrificial layer.

8. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 7, wherein said insulated female mold layer is comprised of photoresist.

9. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 1, wherein a process of manufacturing said core and said coil comprise:

a step of forming coil lower wiring on the substrate;  
a step of forming a first insulating layer on said coil lower wiring;  
a step of forming an electrode layer on said first insulating layer;  
a step of forming an insulated female mold layer on said electrode layer;  
a step of electroplating a magnetic layer in the opening of said insulated female mold layer on said electrode layer;  
a step of forming a second insulating layer on said magnetic layer; and  
a step of forming coil upper wiring on said second insulating layer.

10. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 9, wherein said insulated female mold layer is comprised of photoresist.

11. (Original) An optical scanner, comprising:  
a movable mirror; and  
the electromagnetic actuator according to claim 2 mechanically connected with said movable mirror.

12. (Withdrawn) A method of manufacturing the electromagnetic actuator according to claim 2, wherein a process of manufacturing said stator, said movable element and said supporting means comprises:

a step of forming a sacrificial layer on a substrate;  
a step of forming an electrode layer on said substrate and said sacrificial layer;  
a step of forming an insulated female mold layer on said electrode layer;  
a step of electroplating a magnetic layer in an opening of said insulated female mold layer on said electrode layer; and  
a step of removing said insulated female mold layer and said sacrificial layer.

13. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 12, wherein said insulated female mold layer is comprised of photoresist.

14. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 2, wherein a process of manufacturing said core and said coil comprise:

- a step of forming coil lower wiring on the substrate;
- a step of forming a first insulating layer on said coil lower wiring;
- a step of forming an electrode layer on said first insulating layer;
- a step of forming an insulated female mold layer on said electrode layer;
- a step of electroplating a magnetic layer in the opening of said insulated female mold layer on said electrode layer;
- a step of forming a second insulating layer on said magnetic layer; and
- a step of forming coil upper wiring on said second insulating layer.

15. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 14, wherein said insulated female mold layer is comprised of photoresist.

16. (Original) An optical scanner, comprising:

- a movable mirror; and
- the electromagnetic actuator according to claim 3 mechanically connected with said movable mirror.

17. (Withdrawn) A method of manufacturing the electromagnetic actuator according to claim 3, wherein a process of manufacturing said stator, said movable element and said supporting means comprises:

- a step of forming a sacrificial layer on a substrate;
- a step of forming an electrode layer on said substrate and said sacrificial layer;
- a step of forming an insulated female mold layer on said electrode layer;
- a step of electroplating a magnetic layer in an opening of said insulated female mold layer on said electrode layer; and
- a step of removing said insulated female mold layer and said sacrificial layer.

18. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 17, wherein said insulated female mold layer is comprised of photoresist.

19. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 3, wherein a process of manufacturing said core and said coil comprise:

- a step of forming coil lower wiring on the substrate;
- a step of forming a first insulating layer on said coil lower wiring;
- a step of forming an electrode layer on said first insulating layer;
- a step of forming an insulated female mold layer on said electrode layer;

a step of electroplating a magnetic layer in the opening of said insulated female mold layer on said electrode layer;

a step of forming a second insulating layer on said magnetic layer; and

a step of forming coil upper wiring on said second insulating layer.

20. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 19, wherein said insulated female mold layer is comprised of photoresist.

21. (Original) An optical scanner, comprising:

a movable mirror; and

the electromagnetic actuator according to claim 4 mechanically connected with said movable mirror.

22. (Withdrawn) A method of manufacturing the electromagnetic actuator according to claim 4, wherein a process of manufacturing said stators, said movable element and said supporting means comprises:

a step of forming a sacrificial layer on a substrate;

a step of forming an electrode layer on said substrate and said sacrificial layer;

a step of forming an insulated female mold layer on said electrode layer;

a step of electroplating a magnetic layer in an opening of said insulated female mold layer on said electrode layer; and

a step of removing said insulated female mold layer and said sacrificial layer.

23. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 22, wherein said insulated female mold layer is comprised of photoresist.

24. (Withdrawn) The method of manufacturing the electromagnetic actuator to claim 4, wherein a process of manufacturing said core and said coil comprise:

- a step of forming coil lower wiring on the substrate;
- a step of forming a first insulating layer on said coil lower wiring;
- a step of forming an electrode layer on said first insulating layer;
- a step of forming an insulated female mole layer on said electrode layer;
- a step of electroplating a magnetic layer in the opening of said insulated female mold layer on said electrode layer;
- a step of forming a second insulating layer on said magnetic layer; and
- a step of forming coil upper wiring on said second insulating layer.

25. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 24, wherein said insulated female mold layer is comprised of photoresist.

26. (Original) An optical scanner, comprising:



a movable mirror; and

the electromagnetic actuator according to claim 5 mechanically connected with said movable mirror.

27. (Withdrawn) A method of manufacturing the electromagnetic actuator according to claim 5, wherein a process of manufacturing said stator, said movable element and said supporting means comprises:

- a step of forming a sacrificial layer on a substrate;
- a step of forming an electrode layer on said substrate and said sacrificial layer;
- a step of forming an insulated female mold layer on said electrode layer;
- a step of electroplating a magnetic layer in an opening of said insulated female mold layer on said electrode layer; and
- a step of removing said insulated female mold layer and said sacrificial layer.

28. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 27, wherein said insulated female mold layer is comprised of photoresist.

29. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 5, wherein a process of manufacturing said core and said coil comprise:

- a step of forming coil lower wiring on the substrate;

a step of forming a first insulating layer on said coil lower wiring;  
a step of forming an electrode layer on said first insulating layer;  
a step of forming an insulated female mold layer on said electrode layer;  
a step of electroplating a magnetic layer in the opening of said insulated female mold layer on said electrode layer;  
a step of forming a second insulating layer on said magnetic layer; and  
a step of forming coil upper wiring on said second insulating layer.

30. (Withdrawn) The method of manufacturing the electromagnetic actuator according to claim 29, wherein said insulated female mold layer is comprised of photoresist.